JFSP Project Highlights

Research Supporting Sound Decisions

March 2005

Real-Time Evaluation of Effects of Fuel-Treatments and Other Previous Land Management Activities on Fire Behavior during Wildfires

Background

This project utilized a rapid response team to measure pre-, during, and post-fire fuel conditions and fire behavior on wildland fires during the summer and fall of 2003. Nine fires were visited in Montana and California in areas with various fuel treatments, past fires and other land-use management activities. Pre-measurements were taken and data recorders were set up to capture fire behavior characteristics during the wildfire events. Fire behavior and associated post-fire fuels data were successfully measured and summarized on two of the fires. The team was able to record one fire's path through two contrasting (open and closed forest) sites, including high intensity, rapid crown fire behavior.

Objectives

The primary goal of the project was to prototype in-situ measurements *during* wildfires to assess changes in fire behavior through fuel treatments, past land-use activities or old fires. Specific objectives included:

1) Directly measuring the effects of fuel treatments at the site and landscape scales on fire behavior during wildfires.
2) Comparing effects of different types and degrees (intensity and landscape extent) of fuel treatments or other past land-use activities (such as, timber harvest) on fire behavior at the site and landscape scales.
3) Improving the understanding and modeling of the relationships between measurements of crown fuels and fire behavior.

The approach used was to find fuel treatments, past land-use activity or old fires in the path of wildfires and to obtain fuel measurements and set up fire behavior sensors ahead of the fire. Key elements of the study design included working successfully with incident management teams on the active parts of fires, equipment and sensor operation and design, and operational procedures and methods for collecting data.

Crew completing pre-burn site measurements

Results

The primary fire behavior responses measured included: rate of spread, temperature, heat flux (total, radiant, and, by subtraction, convective), fire type (surface, passive or active crown), flame geometry and fireline intensity.

Although both sites at the Black Mountain II Fire exhibited intense crown fire behavior, there were some findings that have implications for both fuel treatments and fire behavior prediction models that are used extensively in fire and land-use management planning. First, rates of spread of spread were lower in the more open stand, despite the prevalence of higher levels of 1-hour fuels that current fire behavior models emphasize for surface rate of spread. This suggests that relative importance of crown fuels in determining rate of spread of crown fires and linkage of crown fuels with surface fuels may differ than currently predicted in fire behavior models. FARSITE is based on assumptions that surface rate of spread in dependent crown fires comes from fuel model 10. This study suggests that multiple assumptions for surface models or different means for linking surface and crown fire behavior models may be needed.

The JFSP, a partnership of six federal wildland fire and research organizations, provides scientific information and support for fuel and fire management programs.

JFSP Contacts

Erik Berg
Program Manager
208-387-5349

Becky Jenison
Program Assistant
208-387-5958

Tom Wordell
Fire Technology Transfer Specialist
208-387-5865

jfsp.nifc.gov

Secondly, this study provided further evidence that the size and placement of fuel treatments has important implications for fuel breaks or defensible fuel profile zones, particularly under high or extreme weather and fire behavior conditions in order for the fuel treatment to be effective in changing fire behavior.

Third, heat flux measurements indicated a substantial component of convective heat transfer, although current fire behavior models often incorporate convective transfer as a more minor component or as a cooling mechanism. The study team believes more work is needed to quantify and understand the relative role of convective transfer, especially since convective heat transfer is a key safety concern for firefighters utilizing safety zones during suppression, and because it is more difficult to predict in the field than radiant heat transfer.

Crown fire through the dense, untreated Douglas-fir site, Black Mountain II Fire, Montana 2003

Conclusions

The types of directly measured relationships summarized will improve predictions of fire behavior during wildfire events, help ensure firefighter safety, and increase the scientific basis for planning and implementing fuel reduction programs. Additional field-measured data is needed to address the question of how large or intensive does a fuel treatment need to be to significantly affect fire behavior under various conditions.

The success of this rapid response project was due in large part to the team's extensive coordination with incident management teams and by incorporating experienced firefighters and Incident Management Team members on the project team.

Post burn conditions on the dense, untreated Douglas-fir site, Black Mountain II Fire, Montana 2003

Principal Investigators:

- JoAnn Fites, Fire Ecologist, USDA Forest Service, Adaptive Management Services Enterprise Team, Tahoe National Forest

A final report to the JFSP is available at: http://jfsp.nifc.gov/documents/01C-2-1-08%20final_report.pdf

You can obtain further information at: http://www.fs.fed.us/adaptivemanagement/projects/rapid_response/index.shtml

Download a printable version of this JFSP Project Highlight at http://jfsp.nifc.gov/news/doc/highlight.pdf

Download previous JFSP Project Highlights at http://jfsp/nifc.gov/news/archives.htm